APPENDIX J

ECOLOGICAL ASSESSMENT

EXECUTIVE SUMMARY

A baseline ecological evaluation was completed, using New Jersey Department of Environmental Protection (NJDEP) guidelines, at the OCC Site in Burlington, New Jersey. An environmentally sensitive area - Bustleton Creek - was identified adjacent to the Site. Two groups of chemicals were detected on Site: PCBs and a group of volatile organic compounds (VOCs). Although potential migration pathways of on-Site VOCs to Bustleton Creek exist, no further action was warranted, according to NJDEP guidelines, because the VOCs do not occur in concentrations which are likely to cause harm to natural resources. This assessment was confirmed by historic sampling for VOCs in the water and sediments of Bustleton Creek. Potential migration pathways for on-Site PCBs to Bustleton Creek exist now and have existed in the past, although current migration of ecologically significant amounts of PCBs is somewhat unlikely. Therefore, based on NJDEP guidelines, further investigation was warranted, and sediment samples from Bustleton Creek were collected in December 1998. PCB concentrations in the two samples from Bustleton Creek located closest to the Delaware River were approximately 1 mg/kg, which is above the NJDEP ecological screening level. PCB concentrations decreased with distance from the Delaware River, and were close to the detection limit immediately adjacent to the Outfall from the OCC plant. This spatial pattern indicates the Delaware River as the potential source of the PCBs. The Site is an alternative source, with the spatial distribution explained by the preferential absorption of PCBs in the finer sediments toward the mouth of the creek. Information was not sufficient to distinguish between these two hypotheses. Nonetheless, the potential risk from the PCBs is likely to be minimal because the detected PCB formulation - Aroclor 1242 - has limited potential for both bioaccumulation and toxicity. In addition, the affected area is small and, due to its tidal nature, not prime foraging habitat for fish or the foraging of mammals and birds.

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1.0 INTRODUCTION

According to NJDEP regulations, a baseline ecological evaluation (BEE) should be completed for all contaminated sites. This document presents the results of this evaluation. The BEE is based on historical samples of on-Site soils and groundwater and surface water adjacent the Site described in Section 4.0 of the SI Report, sediment samples that were collected during the Site Investigation (sampled according to Section 5.0 of the SI Report), and a Site visit that occurred in December 1998. The historical data are presented in Section 4.0 of the SI Report, and the results of the sediment sampling are provided in Table 2a of Appendix E of the SI Report.

2.0 EVALUATION OF NATURE OF CHEMICALS AT THE SITE AND IDENTIFICATION OF CHEMICALS OF CONCERN

According to previous Site investigations, there are two classes of chemicals - VOCs and PCBs - that could be considered chemicals of concern. The VOCs consist of PCE, and its breakdown products, TCE, DCE, and vinyl chloride monomer (VCM). VCM was also used at the Site. Information concerning the distributions and concentrations of these chemicals can be found in Section 4.0 of the SI Report. The following describes in general terms, the general characteristics of fate and transport and the ecotoxicology for these chemicals.

2.1 CONTAMINANT FATE AND TRANSPORT

Polychlorinated Biphenyls (PCBs)

PCBs are a group of 209 stable, fat-soluble chemicals. PCBs were sold and used in different formulations or combinations of the different PCB congeners. Aroclor is the commercial name for U.S.-manufactured PCB product mixtures. Different product mixtures are further identified by codes, such as 1242, 1248, 1254, and 1260, which designate the percent of chlorination of the product mixture. That is, higher numbered Aroclors are dominated by more chlorinated congeners. Since the time necessary for different components of PCB mixtures to break down or dissipate in the environment varies, PCB mixtures found in soils, sediments and biota usually have different compositions in comparison to the commercial formulations.

Most PCBs in the environment are similar, but not identical to, Aroclor 1254. . However, the PCB found at Burlington most closely resembled Aroclor 1242. Toxicity, exposure, and environmental persistence depend somewhat on the formulation. In general, more chlorinated formulations show more potential for bioaccumulation, greater persistence in the environment and greater toxicity.

PCBs are very hydrophobic, with log K_{ow} values ranging from 5 to 7. Consequently, the PCBs are sparingly soluble and do not preferentially occur in the environment dissolved in water. Instead, they tend to sorb strongly to surface soils or bottom or suspended sediments in aquatic environments. Therefore, PCBs are relatively immobile in the environment. Migration in the environment is generally tied to movement of particles during surface water flows. PCBs do not generally contaminate groundwater, and

contamination of surface waters occurs primarily via transport of soil particles to these areas during overland flow.

PCBs are persistent substances. Under certain conditions (low particle concentrations in water and low organic matter in soil), PCBs can volatilize to the atmosphere, but this tends to be a somewhat slow process. PCBs also undergo biodegradation, but this is also a slow process. PCBs are very fat-soluble and tend to bioaccumulate and biomagnify in aquatic and terrestrial biota, if they are ingested or otherwise absorbed. Bioconcentration factors in aquatic species such as fish, shrimp, and oysters range from 26,000 to 660,000 L/kg (ATSDR, 1992).

VOCs

PCE, and its breakdown products TCE, DCE, and VCM, were found in groundwater under the Site. The compounds are very soluble in water. They tend to travel dissolved in water and, therefore, will move readily in groundwater. Because they are volatile, reasonably soluble, and not hydrophobic, their persistence in surface water and aquatic sediments tends to be very short. Persistence in surficial soils is also likely to be short, due to their propensity to volatilize to the atmosphere and susceptibility to leaching down into the groundwater. Biodegradation of PCE, TCE, DCE, and VCM can occur, primarily under anaerobic conditions for the first three VOCs.

2.2 MECHANISMS OF ECOTOXICOLOGY

PCB

PCBs are not generally found at concentrations that are acutely toxic to ecological receptors. However, PCBs are toxic over chronic exposures. PCBs tend to biomagnify in terrestrial and aquatic food chains, such that higher concentrations, and higher potential toxicity, tend to occur primarily at upper trophic levels of the food chain. PCB congeners cause myriad effects: reductions in fecundity in both birds of mammals, embryonic and early-life stage mortality in all vertebrates, and, at higher doses, potential liver diseases. Reductions in fecundity and mortality of the young of mammals are thought to be the most sensitive endpoints for PCB ecotoxicology.

In the aquatic environment, PCBs depressed growth in the alga *Chlamydomonas* at concentrations ranging from 11 to 111 µg/L (CCME, 1993). The acute toxicity of PCBs appears to be similar for fish and invertebrates under the same test conditions.

Concentrations causing acute mortality, using flow-through tests, to three invertebrate species ranged from 10 µg/L for the scud (*Gammarus fasciatus*) to 400 µg/L for the damselfly (*Ischnura verticalis*). In fish, those that were newly hatched were more sensitive than those at other life stages. The most sensitive species was the rainbow trout (*Salmo gairdneri*) with the hatchlings having a 96-hour LC_{50} of 2.0 µg/L for Aroclor 1221. Largemouth bass (*Micropterus salmoides*) were reported to have a 96-hour LC_{50} of 2.3 µg/L (CCME, 1993).

In a series (11) of life-cycle and partial-life-cycle tests on fish and invertebrates, chronic toxicity occurred at concentrations that ranged from 0.2 to 15 µg/L (CCME, 1993). Aroclor 1248 was the most toxic Aroclor to fathead minnows at a concentration of 0.3 µg/L in a 9-month continuous-flow bioassay.

PCBs are not highly toxic when given as a single dose to mammals, and would be classified as only slightly toxic based on their acute oral toxicity. The more significant toxic effects of PCBs are observed after repeated exposure over a period a time. Single-dose oral LC_{50} values for PCBs have been reported for rats and mink. The lowest values are 750 mg/kg for Aroclor 1221 in mink and 1,010 mg/kg for Aroclor 1254 in rats (ATSDR, 1992).

PCBs are much more toxic over chronic exposure. Suppression of reproduction appears to be the most sensitive, ecologically relevant endpoint for chronic exposure to PCBs. In general, PCBs tend to be more toxic to mammals than birds. Mink appear to be one of the most sensitive vertebrates. Suppression of mink reproduction can occur at concentrations as low as 1 to 2 ppm in food or less in food.

PCB congeners and formulations, which are combinations of different congeners, vary considerably in their toxicity. For individual congeners, the most toxic are intermediately chlorinated congeners (tetra, penta, and sexa chlorinated biphenyls). For the formulations, which are made up primarily of trichlorinated to heptachlorinated biphenyls, more chlorinated Aroclors tend to be more toxic than less chlorinated Aroclors, although this is not always true. For example, Aroclor 1260 is generally more toxic to mink than Aroclor 1254, which is more toxic than Aroclor 1242 (Leonards et al. 1995). For cancer in rats, however, this relationship between Aroclor chlorination and toxicity is not always clear, although 1260 and 1254 were much more toxic than 1016.

VOCs

The VOCs found at the Site can cause liver tumors in rodents at high doses. The primary exposure route to ecological receptors from these chemicals is via groundwater discharge to nearby surface waters. Once in surface waters, aquatic organisms and terrestrial animals using the water for drinking could face exposure, although persistence in surface waters will be very short.

No toxic effects of TCE on terrestrial plants were reported in the sources reviewed. The oral LD_{50} for dogs was reported at 5.86 grams/kg of body weight. An inhalation LC_{50} was reported for rats at 8,000 mg/L (4 hours). In the aquatic environment, a concentration of 55 mg/L stupefied fish within 10 minutes. 96-hour LC_{50} values for fathead minnows ranged between 40.7 mg/L and 66.8 mg/L (Verchueren, 1983). A concentration of 660 mg/L TCE killed *Daphnia* in 40 hours, but 99 mg/L had no effect (McKee & Wolf, 1963).

No data on the effects of PCE to aquatic plants was reported in the literature sources reviewed. In one study reviewed, the effects of PCE on the growth of lettuce in soil had EC50 values ranging from 3.2 to 8 mg/kg. The mean 96-hour LC_{50}s for fathead minnows and rainbow trout ranged from 13.4 to 23.8 mg/kg and 4.99 to 5.84 mg/L, respectively (CCME, 1993). During one acute toxicity test, it was observed that a number of sub-lethal effects of PCE were occurring to fathead minnows prior to death. Affected fish lost schooling behavior, swam near the surface, were hypoactive, had darkened coloration, had increased respiratory rate, and lost equilibrium (CCME, 1993). The 48-hour LC_{50}s for the invertebrate *Daphnia magna*, ranged from 7.5 to 8.5 mg/L. *Daphnia magna* were most sensitive to PCE during chronic toxicity tests. Growth and reproduction were reduced 7.6 percent and 62 percent, respectively, with a lowest-observed-effect concentration of 1.11 mg/L (CCME, 1993).

Animal studies of oral exposure suggest that anesthesia and death would be likely if high concentrations of PCE were swallowed. There are no reports of fatalities in animals exposed solely by the dermal route (ATSDR No. 3, 1992). PCE has been shown to cause hepatotoxic effects in animals by inhalation and oral routes of exposure, with hepatic lesions induced in experimental animals by inhalation exposure to PCE. Mice appear to be the most sensitive species to this effect. Hepatocellular vacuolization occurred after a single 4-hour exposure of mice to 200 ppm or greater concentrations of PCE. This lesion was also reported in male mice exposed to 875 or 1,750 ppm PCE for 14 days and in females exposed to the highest dose. Vacuolization was not present at 425 ppm. A

number of lesions reported in rats after acute exposure to PCE were relatively nonspecific (ATSDR No. 3, 1992).

Aquatic toxicological data were not obtained for 1,2-DCE and for VCM are very limited. This is not expected to be problematic because residence times in surface water are extremely short for these chemicals. Moreover, DCE can be expected to be considerably less toxic than TCE or PCE. Pennsylvania's water quality criteria for PCE, TCE, and DCE are, respectively, 139 µg/L, 450 µg/L, and 1,492 µg/L.

2.3 IDENTIFICATION OF CHEMICALS OF CONCERN

Chemicals of concern (COC) are defined as those chemicals that exceed relevant toxicological benchmarks or those that bioaccumulate/biomagnify. As a bioaccumulative chemical, PCBs are defined as a chemical of concern. Assessing whether the VOCs are COC is more complicated as the on-Site VOCs occur in groundwater while the applicable criteria apply to surface water in Bustleton Creek. In such cases, it is necessary to make certain assumptions concerning fate and potential dilution of the groundwater as it travels to Bustleton Creek. However, some data are available for chemical concentrations in Bustleton Creek, which eliminates the need for assumptions concerning fate and dilution, and groundwater samples from groundwater wells nearest Bustleton Creek can sometimes be applied to ecological benchmarks as a worst-case analysis.

New Jersey has surface water quality standards for several of the VOCs, but these criteria pertain to human health impacts associated with consumption of drinking water. Bustleton Creek is not used as a source of drinking water, so the applicable toxicological benchmarks are for protection of consumers of aquatic life and for protection of aquatic life. Delaware River Basin Commission has water quality criteria of 8.85 µg/L for PCE, 80.7 for TCE, 3.2 µg/L for DCE (the 1,1-DCE isomer), and 525 µg/L for VCM. These water quality criteria are based on protection of human consumers of fish from cancer caused by these chemicals in fish. As these values pertain to potential for bioaccumulation in fish, which is a relatively long-term process, the criterion must be applied to the long-term average concentration of PCE in the water in which harvestable-size fish reside. Concentrations of PCE in Bustleton Creek were at or very near the limit of detection in the most recent sampling in 1988 and 1989 (see Table 4.11 of the SI Report), and, as a long-term average concentration, have always been well below this water quality criterion. Similarly, concentrations of the other VOCs were below the detection limit in the most recent sampling in 1989, and long-term average

concentrations were always well below these criteria (see Table 4.11 of the SI Report). Thus, none of the VOCs exceed their respective DRBC criteria.

Moreover, there are four reasons why this assessment of no risk is very conservative. First, current concentrations of VOCs in Bustleton Creek should be considerably lower than the less than detect and barely detected values obtained in 1989. Concentrations of PCE in groundwater closest to the Creek have fallen considerably, about 69 percent in the last decade[1], due to ongoing natural attenuation processes. Second, Bustleton Creek can only support harvestable size fish in its lower reaches during high tide. At this time, most of the water in the Creek is tidal inflow from the Delaware River, which would greatly dilute the already negligible amounts of PCE in Bustleton Creek at low tide. Third, given the small size of the Creek at low tide, harvestable fish must spend much of their time in the Delaware River, during which their exposure to PCE Bustleton Creek would be diluted temporally. Fourth, the water quality criteria are based on a lifetime of fish consumption. It is virtually impossible that any group of anglers could obtain a regular, lifetime supply of fish from the small populations of fish likely to inhabit Bustleton Creek.

There are no applicable water quality criteria for protection of aquatic life in the New Jersey standards, but valid toxicological benchmarks for PCE, TCE, and DCE (the 1,1-DCE isomer) were obtained from Pennsylvania, which borders New Jersey across the Delaware River. Pennsylvania has chronic water quality criteria for protection of aquatic life of 139 µg/L, 450 µg/L, and 1,492 µg/L for PCE, TCE, and DCE, respectively. Using a most-conservative methodology, these values could be applied to groundwater in nearby wells, without consideration of dilution and attenuation. Even assuming no dilution, there is no risk to sediment dwelling infauna. Shallow groundwater has only about 10 µg/L PCE with about 50 µg/L in the deeper groundwater, less than 10 percent and 40 percent of the surface water criteria. Potential risks from DCE and TCE are even less because the groundwater concentrations are lower and the water quality criteria are higher than for PCE. No water quality criteria for protection of aquatic life could be found for VCM, but this compound was also considered not problematic given that it was not detected in the groundwater anywhere on Site during the December 1998 sampling.

There were no VOCs detected in the sediment samples for Bustleton Creek. Consequently, according to available data, the VOCs should not be considered chemicals of concern as their concentrations do not exceed relevant ecotoxicological benchmarks.

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1 In 1989, PCE in Wells 3 and 6, deep and shallow, averaged 72.3 µg/L PCE. In 1998, the average concentrations fell 69 percent to 22.8 µg/L.

3.0 IDENTIFICATION OF ON AND OFF-SITE RESOURCES AND POTENTIALLY IMPACTED SENSITIVE AREAS

The area is primarily a working industrial facility consisting of buildings, mowed lawns, and parking lots. This area has minimal to no habitat value. There are a series of drainage ditches on Site that transport stormwater, but these are usually dry and do not constitute aquatic habitat. These are small areas, generally lined with stone, and also have little to no terrestrial habitat value. The Resin Ditch is enclosed in a fence within the property. Some of the on-Site area (to the east and west) is forested/brush. This area could serve as terrestrial habitat to appropriate species. There were no areas of soil staining or stressed vegetation noted.

Running parallel to the south plant boundary is Bustleton Creek. As a body of water, Bustleton Creek is an environmentally sensitive area in New Jersey. The Creek was observed at low tide, but based on observation of the obviously wet areas at the sides of the low tide channel, the zone of significant tidal fluctuations appears to be about half-way to the east end of the property, a short distance upstream of the Outfall. According to conversations with plant personnel, the Creek is weakly tidal at the Outfall. A tidal study done in the 1980s showed a 2.3 feet fluctuation at the outfall.

At its upper reaches near and above the outfall, the Creek is a very small, low gradient, sandy bottom stream. Finer black sediments were found 1 to 2 inches below the light brown, sandy sediments. At low tide, the Creek was a series of long, very shallow pools, with water generally less than 6 inches deep and little net flow. There were few rocks and no real riffle areas in the Creek. Upper reaches of the Creek tended to be less than 15 feet across. Very small fish (less than 2 inches long) were noted in these areas, but the water was too shallow to support any but the smallest fish. The area probably supports amphibians, but none were expected given the timing (December) of the survey. The undersides of several rocks were examined, and some amphipods and snails were detected.

Moving downstream toward the Delaware River, the Creek becomes wider. At a point about halfway between the outfall and the road, the stream channel is underlain by finer, more organic-rich sediment, especially in areas outside the main channel that are exposed to the air during low tide. The sediments of the main channel are a mixture of sand and finer silt. Between the road and the mouth on the Delaware River, the Creek was about 100 feet wide. The main channel at low tide was still, however, quite small and quite shallow, too shallow to support all but the smallest fish. Thus, even the most

downstream sections of the Creek cannot support significant fish populations during low tide, although fish probably move into the Creek at higher tide to feed.

In summary, due to its small size and low flow, the Creek has very limited potential to support fish populations. Fish probably move into the Creek and feed during high tide, but their potential exposure to chemicals contained in the water or sediments would be limited to those areas, and times, in which water is of sufficient depth for a substantial amount of time. During these feeding bouts, impacts would be highly diluted by Delaware River waters. Mammalian and avian predators might also forage on the mudflats and in the Creek. However, their foraging time, and attendant exposures to chemicals, will also be limited by the tidal nature and low carrying capacity of the Creek for fish.

There were no areas, which appeared to be visibly impacted by chemicals, along Bustleton Creek. There was no obviously stressed vegetation.

4.0 EVALUATION OF THE NEED TO CONDUCT FURTHER INVESTIGATIONS

As part of the NJDEP ecological evaluation, an investigation was performed to determine if further analysis is warranted. According to New Jersey regulations, further analysis is warranted if all of the following are true:

i) contaminants of ecological concern exist on Site;

ii) an environmentally sensitive area exists on or immediately adjacent to the Site; and

iii) potential contaminant migration pathways to sensitive area exist or an impact to sensitive area is observed.

4.1 PCE IN ON-SITE GROUNDWATER FLOWING TO BUSTLETON CREEK

In the case of PCE and the other VOCs, the second criterion is satisfied. There is a sensitive area, Bustleton Creek, adjacent to the Site. There is also a potential migration pathway from the on-Site groundwater to the Creek, so the third criterion is also satisfied. However, based on available evidence, no further investigation was necessary, as concentrations of these chemicals off Site are well below levels capable of impacting aquatic life or posing risk to human consumer. Thus, PCE and other VOCs cannot be considered COCs since the first criterion is not satisfied.

Notwithstanding this assessment, VOCs in Bustleton Creek sediments were sampled in December 1998. Consistent with the above analysis, VOCs were not detected in any sediment samples (Table 2a, Appendix E, SI Report). Moreover, OxyChem has agreed with NJDEP to re-sample the creek, again, during low flow, low tide period to further confirm that VOCs are not problematic in the Creek. Based on the analysis above and the available data, it is unlikely that this sample will produce concentrations that are of concern.

4.2 PCBs FROM THE RESIN AND SOUTH DITCHES TO BUSTLETON CREEK

As a bioaccumulative chemical, PCBs at any concentration are defined as a contaminant of concern. Thus, the first criterion is satisfied. An environmentally sensitive area

(Bustleton Creek) is adjacent to the Site and thus, the second criterion is also satisfied. It is not believed that the third criterion is satisfied with respect to groundwater. PCBs do not readily move in groundwater and were not detected in Site groundwater. Consequently, there is little potential for on-Site PCBs to travel to Bustleton Creek via groundwater and this migration pathway was considered incomplete.

There is a potentially complete migration pathway from PCBs in the Resin and South Ditch via stormwater discharge to Bustleton Creek. However, the available data suggest that this pathway is currently limited/incomplete. For one, the Resin Ditch no longer receives process cooling water, and direct rainfall onto the ditch will tend to infiltrate into the porous sandy soil. Consequently, flows from the Resin Ditch are now likely to be too limited to carry significant amounts of particles. This hypothesis is supported by the data. Although PCBs were found in the ditches that eventually drain to the Creek, concentrations in sediments drop rapidly from the upstream edge of the Resin Ditch to the South Ditch. In 1989 and 1990, the surface sediment/soil in the Resin Ditch had an average PCB concentration of 29.4 mg/kg, while geometric mean concentrations in the South Ditch were about 16 times lower, 1.9 mg/kg, when non-detects were set equal to 0.5 mg/kg (Figures 4.2 and 4.3 of the SI Report).

Another factor potentially limiting this current migration pathway is the weir at the Outfall. The weir acts as a retaining structure causing the water to pool behind it during high flow events in which water is draining from the Resin Ditch and South Ditch. The pooled area immediately upstream of the weir will be a depositional area for sediments, and adsorbed PCBs, from the South Ditch and the Resin Ditch. Measured PCB concentrations, based on sampling in 1990, were below the limit of detection at this deposition point, suggesting that ecologically significant releases of PCBs are not now occurring (Section 4.0, SI Report).

Notwithstanding these data, a "potential" migration pathway could now exist from the Resin and South Ditches to the Bustleton Creek. This migration pathway would also have been more likely in the past when the Resin Ditch was a conduit for stormwater. Consistent with NJ regulations, further analysis was warranted. Consequently, samples of the Creek sediments were collected in early December 1998, to determine if this migration pathway is/had been complete. These data are described below.

4.2.1 RESULTS OF THE 1998 SAMPLING

PCBs were sampled at four spots in Bustleton Creek; above the Outfall at the approximate junction between the tidal and non-tidal regions; directly at the Outfall; a station about halfway between the Outfall and the road; and a fourth station between the road and the mouth on the Delaware River (Figure 5.6 of the SI Report). Total PCB concentrations at these four locations were: below detection at the upstream location; 0.032 mg/kg at the Outfall; 0.79 mg/kg further downstream; and 1.01 mg/kg near the confluence with the Delaware River (Table 2a, Appendix E of the SI Report). The PCBs were all Aroclor 1242 except in the last sample which contained low level concentrations of Aroclor 1260 (0.055 mg/kg). These three values exceed the NJDEP sediment screening levels for PCBs of 0.023 mg/kg (NJDEP 1998).

The available information is not sufficient to identify the source of the PCBs. On the one hand, the PCB concentrations are highest closest to the Delaware River, and PCB concentrations at all locations in Bustleton Creek are directly proportional to the degree of tidal influence. This relationship suggests that the PCBs came in from the Delaware River during high tides. PCBs are found throughout the Delaware River, so inflowing water would bring PCBs into Bustleton Creek from the Delaware River. An alternate source is the Site, where the majority of the PCBs were Aroclor 1242. The sediments in the upper reaches of the Creek are sandy and coarse grained and the downstream Bustleton Creek sediments are finer, more organic-rich mud. Potentially, the PCBs could have come from the Site and been preferentially captured downstream by the fine sediments. However, even if it is assumed that the Site was the source of the PCBs in the sediments, this does not suggest that the Site continues to be a significant source. The available data (as noted above in discussion of the lower industrial ditch) suggest that the current migration pathway is likely to be minor. It should also be noted that future remediation of the industrial resin ditch will further mitigate future impacts.

Regardless of the source(s), current or past, the risk from these PCBs in Bustleton Creek sediments is likely to be minimal. NJDEP's sediment benchmark for PCBs, the NOAA ERL (Environmental Response Low) value, is not a credible predictor of impact to aquatic benthos. PCBs are not very toxic to benthic organisms, and the NOAA ERL and ERM benchmarks were generated in a scientifically suspect manner (i.e., very simplistic analyses of sediments with multiple chemical and non-stressors). Consequently, exceedance of this screening benchmark implies very little concerning risk to aquatic organisms.

Due to their greater sensitivity and exposure via the food chain, ecological risk from PCBs is primarily a function of food chain exposure and, after that, persistence in the bodies of vertebrates. This risk from food chain exposure is likely to be greatly reduced by Site conditions in Bustleton Creek. Aroclor 1242 poses much less risk, than most other PCB formulations, in terms of both exposure and toxicity after exposure. For example, the bioaccumulation potential of 1242, from sediments to fish, is about one-half to one-quarter that of Aroclor 1254 and 1260 (Oliver and Niimii 1988). In addition, the toxicity of Aroclor 1242 is considerably less than the more chlorinated Aroclors. According to Leonards et al. (1995), mink are less sensitive to less chlorinated Aroclors. Aroclor 1242 is about half or less as toxic as 1254, which in turn is less toxic than 1260. Tidal Delaware mud flats are, during the summer, quite warm and often anoxic, which are conditions optimal for dechlorination of the more toxic PCBs congeners (Abramowitz 1990).

The small size and tidal nature of the Creek will also significantly reduce exposure and risk. The areas with a high PCB concentration are nearly completely tidal. The habitat consists of mud flats for some amount of time and the water is too shallow to support large fish for much of the rest. While the mud flats will support benthic organisms that will serve as food for large fish and terrestrial animals, the total foraging time, and exposure, for both types of predators will be limited by the tides. Assuming that exposure to PCBs depends on potential foraging time, the PCBs in Bustleton Creek pose a much-reduced hazard to human health and wildlife. Thus, the risk from the PCBs in the Bustleton Creek sediments is judged to be minimal.

Also, future impacts will be highly mitigated by the removal of PCB mass from the resin ditch, when that remediation is performed later this year.

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